

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
17 November 2005 (17.11.2005)

PCT

(10) International Publication Number  
**WO 2005/108635 A2**

(51) International Patent Classification<sup>7</sup>: **C22C 27/06**

(21) International Application Number:  
PCT/US2005/015703

(22) International Filing Date: 4 May 2005 (04.05.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/569,659 6 May 2004 (06.05.2004) US  
11/041,185 24 January 2005 (24.01.2005) US

(71) Applicant: **TINI ALLOY COMPANY [US/US]**; 1619 Neptune Drive, San Leandro, CA 94577 (US).

(74) Agent: **BACKUS, Richard, E.**; Law Offices of Richard E. Backus, 887-28th Avenue, San Francisco, CA 94121 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

**WO 2005/108635 A2**

(54) Title: SINGLE CRYSTAL SHAPE MEMORY ALLOY DEVICES AND METHODS

(57) **Abstract:** Devices and methods of making devices having one or more components made of single crystal shape memory alloy capable of large recoverable distortions, defined herein as "hyperelastic" SMA. Recoverable Strains are as large as 9 percent, and in special circumstances as large as 22 percent. Hyperelastic SMAs exhibit no creep or gradual change during repeated cycling because there are no crystal boundaries. Hyperelastic properties are inherent in the single crystal as formed: no cold work or special heat treatment is necessary. Alloy components are Cu-Al-X where X may be Ni, Fe, Co, Mn. Single crystals are pulled from melt as in the Stepanov method and quenched by rapid cooling to prevent selective precipitation of individual elemental components. Conventional methods of finishing are used: milling, turning, electro-discharge machining, abrasion. Fields of application include aerospace, military, automotive, medical devices, microelectronics, and consumer products.